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Method of manufacturing a wiring circuit board with micro-pin

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Specification

1. Title of invention

Method of manufacturing a wiring circuit board with micro-pin

2. What is claimed is:

A method of manufacturing a wiring circuit board having a circuit board on which wiring layers are formed, and the above-described wiring circuit board is connected to pad layers which are formed on the above-described circuit board.

A method of manufacturing board forming a pillar with a smaller cross section of the above-described wiring circuit composed of an organic polymer on the pad layers of the above-described wiring board.

A method of manufacturing a wiring circuit board with micro-pin forming consecutively extendable conductive layers by metal plating on the outside surface of the above pillar and the above pad layers, and a method of manufacturing a wiring circuit board with micro-pin characterized by the structure that the step can be made as micro-pin forming the consecutively extendable conductive layers on the outside surface of the above pillar and the above pad layers.

3. The detailed description of the invention

This invention relates to a method of manufacturing wiring circuit board, and particularly relates to a method of manufacturing wiring circuit board with micro-pin having a process that the wiring layers are formed on the circuit board, and the above-described wiring layers prepare the wiring board which is connected to the pad layers formed on the circuit board and a micro-pin is established to connect the wiring layers of the wiring board of the above-described pad layers from the outside.

Conventionally, as shown in the figure U in Fig. 1 as a whole, as of a wiring circuit board with micro-pin, on the main surface 2 of the circuit board 1 having a nature of insulation, insulation layers 4 which provide plural windows 3 are formed facing the outside to them, and in the position of inside the plural windows 3 of the insulation layers 4, the pad layers 5 are formed, and on the other hand, the plural wiring layers 6 are formed on the insulation layers 4 which are connected and extended to the plural pad layers 5 each, and thus in the condition that on the outside circumference area of the plural wiring layers 6 and the plural pad layers 5 providing the plural windows 7 that face the insulation layers 4 and the consecutively extendable plural pad layers 5 from the outside each other and the insulation layers 8 are laying, the plural wiring layers 6 are formed on the circuit board 1, and those plural wiring layers 6 provide the wiring circuit board 9 with the structure that those plural wiring layers 6 are connected with each of the plural pad layers 5 formed on the circuit board 1. And thus, the things of the structure are proposed such as the plural reverse T letter-shaped micro-pin 10 seen from the vertical section to connect the plural wiring layers 6 of the wiring circuit board 9 on the pad layers 5 of the wiring circuit board 9 by using a solder 11.

As the circuit board U with the micro-pin that has such structure as establishing the micro-pin 10 to connect plural wiring layers 6 of the wiring circuit board 9 on the pad layers 5 of the wiring circuit board 9, it has two wiring circuit boards U like U1 and U2, and thus if it is necessary to connect those two wiring circuit boards U with the micro-

pins like U1 and U2, it has the characteristics to make that connection easily.

In other words, as shown in Fig. 2, with the condition that extendable plural holes 24 are formed on the insulation circuit board 21 between the main surface 22 and 23 which front relatively each other, and a fluid conductor 25 like mercury accommodates inside each hole, if a connector board B is prepared composing plural sockets 26 by the plural holes 24 and the fluid conductor 25 to accommodate respectively in the insulation circuit board 21, only connecting wiring circuit boards U1 and U2 with the micro-pins to the connector board B having a structure that such micro-pins 10 to be inserted inside the socket 26 of the connector board B from the main surface 22 of the board B and 23 side, the micro-pins 10 of the wiring circuit boards U1 and U2 with the micro-pins can be connected through the fluid conductor 25 composing the socket 26, and it has the characteristics that the wiring layers 6 of the wiring circuit boards U1 and U2 can be connected each other.

A method of manufacture a wiring circuit board U with micro-pin that has such characteristics is proposed as follows accompanied by Fig. 4 and Fig. 5 conventionally.

In other words, as shown in Fig 4., the plural wiring boards 6 are formed on the circuit board 1 that are same as the above mentioned wiring circuit board 9 in Fig. 1 in advance, and the wiring circuit board 9 with the structure that those plural wiring boards 6 are connected to the circuit board 9 formed on the plural pad layers 5 is prepared.

On the other hand, a conductor board 31 is prepared as shown in Fig. 5A

in advance, and as shown Fig. 5B, on the main surface 32 of the conductor board 31, mask electrode 35 with the structure that the plural holes 34 of the conductor board 33 are provided in parallel with the main surface 32 confronted closely, and between the mask electrode 35 and the conductor board 31, a required power source 36 is connected, so the electricity is discharged. This remove the domain of the conductor board 31 that confronts the domain except the holes 34 of the mask electrode 35 from the main surface 32 side, and by this, the mask electrode 35 should be descended keeping the relation in parallel with the main surface 32' constantly from the other main surface 32' that confront the main surface 32 of the conductor board 31, and the electric discharging process has been done using the mask electrode 35 from the main surface 32 side of the conductor board 31. And thus, as shown in Fig. 5C, at the position of the opposition side of the both main surfaces 32' of the conductor board 31, plural conductor pillars 37 are formed having a size adapting to the holes 34 of the mask electrode 35 in the cross section.

Next, as shown Fig. 5D, on the top end 38 of the plural conductors 37, on the condition that in the conductor board 41 providing holes 42 that have smaller ratio of the above mentioned hole 34 of the mask electrode 35 and those plural holes 42 confronting both top ends 38 of the each plural conductor pillar 37, the top end should be confronted closely parallel to the top end 38, and between the mask electrode 43 and the conductor board 31, a power source 44 is connected and the electricity is discharged among the mask electrode 43 and plural conductor pillars 37. And this remove the domain that confront the domain except the hole 42 of

the mask electrode 43 from the top end 38 side to the each plural conductor pillar 37, and according to this, the mask electrode 43 should be descended to the main surface 32' of the conductor board 31 keeping the relation parallel to the main surface 32' and the discharging process using the mask electrode 43 from the top end side 38. And thus, as shown in Fig. 5E, at the upper end surface 38 of the plural conductor pillars 37, the conductor pillar department 45 is formed having the size adapting to the hole 42 of the mask electrode 43 seeing from the cross section.

Next, plural conductor pillars 37 are cut along the surface 46 which is parallel to the main surface 32 ' of the conductor board 31 that pass through the side of the conductor board 31 from the conductor department 45 side shown as in Fig. 5E, and thus as shown in Fig. 5F, the reverse T letter shape micro-pin 10 constructing the conductor pillar 45 side rather than surface 46 of the plural conductor pillars 37 can be obtained seeing from the cross section.

After that, as shown in Fig. 5F, the reverse T letter shape micro-pin 10 seeing from the cross section which is obtained as above mentioned is established by a solder 11 on the plural pad layers 5 of the wiring circuit board 9 prepared in advanced as shown in Fig. 4 as mentioned in Fig. 5G, and thus an aimed wiring circuit board U with micro-pin can be obtained.

As mentioned above, a method of manufacturing a wiring circuit board U with micro-pin conventionally proposed was clarified. However, in case of the conventional method, as mentioned in Fig. 5F, it takes mach labor and time to establish the micro-pin 10 on the plural pad layers 5 of the

wiring circuit board 9 in advance using the solder 11, and if each micro-pin 10 is not established on the fixed position precisely to the pad layer 5, for all the more reason that the wiring circuit board with micro-pin cannot be connected smoothly to the connector board B as shown in Fig. 3, each micro-pin 10 must be established on the fixed position precisely to the pad layers 5.

In case of the above-mentioned conventional method, firstly a micro-pin 10 starts from the conductor board 31 and forms a conductor pillar 37 of the conductor board 31 by the electric discharging process, and then by the electric discharging process to the conductor pillar 37, it forms the conductor department 45 to the conductor pillar 37, and after that, the process that the conductor pillar 37 is cut can be obtained, and the micro-pin 10 can be obtained with the larger material waste, and so the micro-pin 10 can be obtained expensively. And if the fluid conductor 25 constructing the socket 26 of the connector board B is mercury, the micro-pin 10 is needed to be platinum that is not infringed by mercury, and in case that the conductor board 31 should be platinum, the result is larger.

Therefore, this invention is proposing a new method of manufacturing a wiring circuit board with micro-pin without a defect for the above-mentioned conventional method. The details are as follows:

Fig. 6 shows an example of a method of a manufacturing a wiring circuit board with micro-pin of this invention. As shown in Fig. 6A, wiring layers 6 that are same as the above mentioned wiring circuit 9 are formed on the circuit board 1, and those plural wiring layers 6 prepare the

wiring circuit board 9 of which structure is the plural pad layers are connected to the pad layers 5 formed on the circuit board 1. Further, reference numbers are put to the corresponding parts to the above mentioned wiring circuit board 9 in Fig. 4 except the above mentioned circuit board itself 1, pad layers 5 and wiring layers 6 in Fig. 6A, so the detail explanation is omitted.

Therefore, as shown in Fig. 6B, on the main surface of the wiring circuit board 9 at the side having the pad layers 5, a protective layer 51 formed with the products such as chromium of the thickness of 500A are formed by the evaporation adherence.

Next, as shown in Fig. G, on the protective layers 51, heat bridge form organic molecule materials, and organic polymer materials layers 52 formed of such as polyimide are arranged. And, in this case, the structure that the organic polymer materials layers 52 arranged on the conductor layer 51 can be obtained by spraying the organic polymer materials and also can be obtained by heating and adhering the organic polymer materials that was obtained in seat-shaped condition in advance. The latter case is shown in the figure.

Next, as shown in Fig. 6D, for example, round-shaped mask layers 54 composed of aluminum are formed by a photolithography method. In this case, the mask layers 54 possess a position and size to be contained within a territory facing the window of the insulation layers 8 of the pad layers 5.

Next, the mask layers 54 corresponding to the organic polymer materials layers 52 should be the mask, and by the etching process of the

responsive ion etching process using enzyme gas, for example, as shown in Fig. 6E, by removing the territory except the territory under the mask layers 54 of the organic polymer materials layers 52, and the pillar 54 composed of the organic polymer materials under the territory of the mask layer 54 is formed. In this case, the protective layers 51 are formed under the organic polymer materials layers 52, and by the protective layers 51, pad layers 5 are protected and they are free from etching.

Next, as shown in Fig. 6F, by using common or different etching liquid corresponding to each, the mask layers 54 and the protective layers 51 on the pillar 51 are removed, and thus, on the pad layers 5, the pillar with an organic polymer materials having a smaller cross section to them are formed. In this case, it has the structure that the territory under the pillar 55 of the protective layers 51 is left as layers 56 and that the pillar 55 is formed through the layers 56 on the pad layers 5.

Next, as shown in Fig. 6G, active layers 58 which will be a catalyst in the electro-less plating process on the outside surface of the pillar 55 by metal ions such as Pd ion are formed.

Next, as shown in Fig. 6H and as mentioned above, by the electro-less plating process of conductor materials such as copper, platinum and so on to the pillar 55 and the pad layers 5 with which the active layers 58 are formed on the outside surface of the pillar 55 and the pad layers 5, consecutively extendable conductive layers 59 are formed, and thus, the structure that the consecutively extendable conductive layers 59 on the pillar 55 and the pad layers 5 are formed as a reverse T letter-shaped micro-pin 10.

Next, in case that the conductive layers 59 which are formed on the outside surface of the pillar 55 and the pad layers 5 forming the micro-pin 10 can be the conductive materials like copper for example, as shown in Fig. 6I, metal plating can be done using the conductive materials to the micro-pin 10 such as platinum which doesn't oxidize easily, and on the surface of the conductive layer 59, conductor layers 60 which has a difficulty to oxidize are formed.

As shown in Fig. 6H or Fig. 6I, the wiring layers 6 are formed on the circuit board 1 same as above mentioned in Fig. 1, and the wiring layers 6 have the circuit board 9 with the structure that wiring layers 6 are formed on the wiring circuit board 1 to be connected with the pad layers 5, and the wiring circuit board U with micro-pin can be obtained on the above-described pad layers 5 with the structure that the micro-pins 10 is established to connect the wiring layers 6 of the wiring circuit board 9 to the outside.

As mentioned above, the first example of a method of manufacturing a wiring circuit board U with micro-pin of this invention is clarified. According to this method, this is the method that obtain the proposed wiring circuit board with micro-pin including the following steps; a step (Fig. 6A) that prepares the wiring circuit board 9 in advance with the structure that on the wiring circuit board 1, the wiring layers 6 are formed and the above-described wiring layers 6 are connected to the pad layers 5 formed on the circuit board 9, and a step (Fig. 6B-F) that forms the pillar 55 consisting of the organic polymer materials which has a smaller cross section than the pad layers on the pad layers 5 of the

wiring circuit 9, and a step (Fig. 6G & H) that on the outside surface of the pillar 55 and the pad layers 5, the consecutively extendable conductive layers 59 are formed by the metal plating process, and the consecutively extendable conductive layers 59 are formed on the outside surface of the pillar 55 and the pad layers 5 as the micro-pins 10. With this method, as it is not needed to establish the plural micro-pins 10 requiring much labor and cost to the plural pad layers 5 of the wiring circuit board 9 that prepared in advance as mentioned in the conventional method in Fig. 4 and Fig. 5, the micro-pins 10 have a structure that can easily positioned and established on the positioned place of the pad layers 5. And in case of this method, as it is not needed that the micro-pins 10 should not start from the conductive layers as mentioned in the conventional method in Fig. 4 and Fig. 5, and also the micro-pins 10 should not be constructed from the conductor through all section, and have the structure that the conductive materials 59 are formed on the outside surface of the pillar 55 and the pad layers 5 consisting from organic polymer materials, only small amount of conductive materials are needed to construct the micro-pins 10, and therefore it has large characteristics that a wiring circuit board with micro-pin U can be provided cheaply. Furtherer, the above mentioned method is just an example of a manufacturing method of a wiring circuit board with micro-pin of this invention, and in the process of forming the pillar 55 consisting from organic polymer materials, forming a pillar 55 consisting from the organic polymer materials without protective layers 51 can be achieved.

Moreover, on the outside surface of the pillar 55 consisting from the organic polymer materials and pad layers 5, the consecutively extendable conductive layers 59 can be formed by the metal plating process, and in the process that the forming structure of the consecutively extendable conductive layers 59 on the outside surface of pillar 55 and the pad layers 5 as the micro-pins 10, instead of the metal plating process, the electro-less process is used and electrolytic metal plating process can be achieved. Further, in this case, the electrolytic metal plating process can be done only to connect the pad layers 5 to the power source.

Other different patterns and changes will be able to be made within the range that doesn't deviate from the intention of this invention.

4. Brief description of the figures

FIG. 1 is a cross-sectional view abbreviating lines of a conventional wiring circuit board with micro-pin. Fig. 2 is a cross-sectional view abbreviating lines showing a connector board to use the connection of the two wiring circuit boards with micro-pins. Fig. 3 is a cross-sectional view abbreviating lines showing the condition that the wiring layers of the two wiring circuit boards with micro-pins are connected by the connector board that shown in Fig. 2. Fig. 4 and Fig. 5A～G are cross sectional views abbreviating lines showing the each process of a conventional wiring circuit board with micro-pin.

Fig. 6A～I is a cross sectional view abbreviating lines in each process that shows an example of a method of a wiring circuit board with micro-pin of this invention.

1 Wiring circuit board

5 Pad layers

6 Wiring layers

9 Wiring circuit board

10 Micro-pin

51 Protective layers

52 Organic polymer material

54 Mask layers

55 Pillar consisting from organic polymer material

59 Conductive layers

60 Resistible oxide conductive layers